WHAT IS CLAIMED IS:

1. A method of providing automatic gain and tilt control in a WDM (wavelength division multiplexing) optical communication system, the method comprising:

receiving at least one reference signal over an optical fiber;

detecting the reference signal;

analyzing the reference signal to determine, in part, power variation of the reference signals;

outputting a control signal to compensate, in part, for losses associated with the optical fiber based upon the analyzing step and gain tilt accumulation; and

controlling an optical gain unit in response to the control signal.

2. The method according to claim 1, wherein the optical gain unit in the controlling step is a Raman pump unit, the method further comprising:

injecting a counter-propagant pump light by the Raman pump unit into the optical fiber in response to the control signal.

3. The method according to claim 2, further comprising:

injecting a co-propagant pump light into the optical fiber by another Raman pump unit.

4. The method according to claim 2, wherein the counter-propagant pump light in the injecting step is produced by a plurality of laser diodes that are controlled to output a plurality of output lights , the output lights being multiplexed.

5. The method according to claim 1, wherein the optical control unit in the controlling step is a variable optical attenuator.

6 The method according to claim 1, further comprising:

receiving another reference signal over the optical fiber, wherein the reference signal occupies a first boundary of a sub-band, and the other reference signal occupies a second boundary of the sub-band.

7. The method according to claim 6, further comprising:

converting the reference signals to corresponding electrical signals.

8. The method according to claim 6, wherein the analyzing step comprises:

computing a relative power difference between the reference signals.

9. The method according to claim 6, wherein the analyzing step comprises:

computing an average voltage of the reference signals; and

comparing the computed average voltage to a reference voltage.

10. The method according to claim 6, wherein the analyzing step comprises:

computing voltages of the reference signals;

comparing the computed voltages to a reference voltage; and

determining whether the reference signals are degraded based upon the comparing step.

11. The method according to claim 10, further comprising:

outputting an alarm signal based upon determining that one of the reference signals is degraded.

12. The method according to claim 1, further comprising:

extracting and regenerating the reference signal.

13. The method according to claim 1, wherein the reference signals in the receiving step are paired to correspond to a sub-band.

14. The method according to claim 13, wherein the sub-band includes at least one of a C-band and a L-band.

15. A WDM (wavelength division multiplexing) optical communication system for providing automatic gain and tilt control, comprising:

an optical fiber that carries a plurality of optical signals, at least one of the optical signals being a reference signal;

an optical gain unit coupled to the optical fiber and configured to output lights to compensate, in part, for losses associated with the optical fiber and gain tilt accumulation;

a controller configured to control the optical gain unit, the controller detecting and analyzing the reference signal to determine, in part, power variation of the reference signal, wherein the controller outputs a control signal to the optical gain unit based upon the analyzed reference signal; and

an optical amplifier coupled to the optical fiber and configured to amplify the optical signals, the optical gain unit providing a constant power per channel at an input of the optical amplifier.

16. The system according to claim 15, wherein the optical gain unit is a Raman pump unit that is configured to inject a counter-propagant pump light into the optical fiber.

17. The system according to claim 15, further comprising:

another Raman pump unit coupled to the optical fiber and configured to inject a co-propagant pump light into the optical fiber.

18. The system according to claim 16, wherein the Raman pump unit is located remotely from the controller.

19. The system according to claim 16, wherein the controller is collocated with the Raman pump unit.

20. The system according to claim 16, wherein the Raman pump unit comprises:

a plurality of laser diodes that are individually controlled to output a plurality of output signals, the output signals being multiplexed.

21. The system according to claim 15, wherein the optical gain unit is a variable optical attenuator that is configured to adjust gain response based upon the reference signal.

22. The system according to claim 15, wherein another one of the optical signals is another reference signal, the reference signal occupying a first boundary of a sub-band, the other reference signal occupying a second boundary of the sub-band.

23. The system according to claim 15, wherein the controller is configured to convert the reference signal to a corresponding electrical signal.

24. The system according to claim 22, wherein the controller is configured to compute a relative power difference between the reference signals.

25. The system according to claim 22, wherein the controller is configured to compute an average voltage of the reference signals and to compare the computed average voltage to a reference voltage.

26. The system according to claim 22, wherein the controller is configured to compute voltages of the reference signals and to compare the computed voltages to a reference voltage to determine whether the reference signals are degraded.

27. The system according to claim 22, wherein the controller is configured to output an alarm signal based upon determining that one of the reference signals is degraded.

28. The system according to claim 16, further comprising:

an optical service channel (OSC) unit configured to extract and regenerate the reference signal, wherein the controller resides within the OSC unit.

29. The system according to claim 22, wherein another one of the optical signals is another reference signal, the system further comprising:

an extraction and regeneration circuit configured to extract and regenerate the reference signals, wherein the controller computes relative power difference and average power of the reference signals.

30. The system according to claim 16, wherein the optical amplifier is an Erbium Doped Fiber Amplifier (EDFA).

31. The system according to claim 16, wherein another one of the optical signals is another reference signal, the reference signals being paired to correspond to a sub-band.

32. The system according to claim 31, wherein the sub-band includes at least one of a C-band and a L-band.

33. An optical device for providing automatic gain and tilt control in a WDM (wavelength division multiplexing) optical communication system, comprising:

an input coupled to an optical fiber, the input receiving a plurality of reference signals;

a plurality of photodiodes configured to convert the reference signals to corresponding electrical signals; and

a controller coupled to the photodiodes and configured to output a control signal to at least one of a Raman pump unit and a variable optical attenuator to compensate, in part, for gain tilt and gain variation based upon the reference signals.

34. The device according to claim 33, wherein the Raman pump unit is configured to inject a counter-propagant pump light into the optical fiber.

35. The device according to claim 33, wherein one of the reference signals occupies a first boundary of a sub-band, and another of the reference signals occupies a second boundary of the sub-band.

36. The device according to claim 33, wherein the controller is configured to compute a relative power difference between the reference signals.

37. The device according to claim 33, wherein the controller is configured to compute an average voltage of the reference signals and to compare the computed average voltage to a reference voltage.

38. The device according to claim 33, wherein the controller is configured to compute voltages of the reference signals and to compare the computed voltages to a reference voltage to determine whether the reference signals are degraded.

39. The device according to claim 38, wherein the controller is configured to output an alarm signal based upon determining that one of the reference signals is degraded.

40. The device according to claim 33, further comprising:

an extraction and regeneration circuit configured to extract and regenerate the reference signals.

41. The device according to claim 33, wherein the reference signals are paired to correspond to a sub-band.

42. The device according to claim 41, wherein the sub-band includes at least one of a C-band and a L-band.

43. A WDM (wavelength division multiplexing) optical communication system for providing automatic gain and tilt control, comprising:

an optical fiber that carries a plurality of optical signals, at least one of the optical signals being a reference signal;

a light emitting means coupled to the optical fiber for outputting lights to compensate, in part, for losses associated with the optical fiber and gain tilt accumulation;

a controlling means for controlling the light emitting means, the controlling means detecting and analyzing the reference signal to determine, in part, power variation of the reference signal, the controlling means outputting a control signal to the optical gain unit based upon the analyzed reference signal; and

an amplifying means coupled to the optical fiber for amplifying the optical signals, wherein the light emitting means provides a constant power per channel at an input of the amplifying means.

44. The system according to claim 43, wherein the light emitting means includes a Raman pump unit that injects a counter-propagant pump light into the optical fiber.

45. The system according to claim 43, further comprising:

another light emitting means that includes a Raman pump unit that injects a co-propagant pump light into the optical fiber.

46. The system according to claim 44, wherein the Raman pump unit is located remotely from the controlling means.

47. The system according to claim 44, wherein the controlling means is collocated with the Raman pump unit.

48. The system according to claim 44, wherein the Raman pump unit comprises:

a plurality of laser diodes that are individually controlled to output a plurality of output signals, the output signals being multiplexed.

49. The system according to claim 43, wherein the light emitting means is a variable optical attenuator that adjusts gain response based upon the reference signal.

50. The system according to claim 43, wherein another one of the optical signals is another reference signal, the reference signal occupying a first boundary of a sub-band, the other reference signal occupying a second boundary of the sub-band.

51. The system according to claim 43, wherein the controlling means converts the reference signal to a corresponding electrical signal.

52. The system according to claim 50, wherein the controlling means computes a relative power difference between the reference signals.

53. The system according to claim 50, wherein the controlling means computes an average voltage of the reference signals and compares the computed average voltage to a reference voltage.

54. The system according to claim 50, wherein the controlling means computes voltages of the reference signals and compares the computed voltages to a reference voltage to determine whether the reference signals are degraded.

55. The system according to claim 50, wherein the controlling means outputs an alarm signal based upon determining that one of the reference signals is degraded.

56. The system according to claim 44, further comprising:

an optical service channel (OSC) unit configured to extract and regenerate the reference signal, wherein the controlling means resides within the OSC unit.

57. The system according to claim 43, wherein another one of the optical signals is another reference signal, the system further comprising:

extraction and regeneration means for extracting and regenerating the reference signals, wherein the controlling means computes relative power difference and average power of the reference signals.

58. The system according to claim 43, wherein the amplifying means is an Erbium Doped Fiber Amplifier (EDFA).

59. The system according to claim 43, wherein another one of the optical signals is another reference signal, the reference signals being paired to correspond to a sub-band.

60. The system according to claim 59, wherein the sub-band includes at least one of a C-band and a L-band.